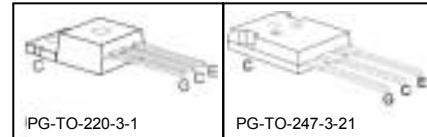
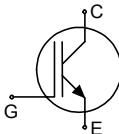


High Speed IGBT in NPT-technology

- 30% lower E_{off} compared to previous generation
- Short circuit withstand time – 10 μ s
- Designed for operation above 30 kHz
- NPT-Technology for 600V applications offers:
 - parallel switching capability
 - moderate E_{off} increase with temperature
 - very tight parameter distribution
- High ruggedness, temperature stable behaviour
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC¹ for target applications
- Complete product spectrum and PSpice Models : <http://www.infineon.com/igbt/>



Type	V_{CE}	I_c	E_{off}	T_j	Marking	Package
SGP30N60HS	600V	30	480 μ J	150°C	G30N60HS	PG-T0-220-3-1
SGW30N60HS	600V	30	480 μ J	150°C	G30N60HS	PG-T0-247-3-21

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	600	V
DC collector current	I_c		A
$T_C = 25^\circ\text{C}$		41	
$T_C = 100^\circ\text{C}$		30	
Pulsed collector current, t_p limited by $T_{j\max}$	I_{Cpuls}	112	
Turn off safe operating area	-	112	
$V_{CE} \leq 600\text{V}$, $T_j \leq 150^\circ\text{C}$			
Avalanche energy single pulse $I_c = 20\text{A}$, $V_{CC}=50\text{V}$, $R_{GE}=25\Omega$ start $T_j=25^\circ\text{C}$	E_{AS}	165	mJ
Gate-emitter voltage static transient ($t_p < 1\mu\text{s}$, $D < 0.05$)	V_{GE}	± 20 ± 30	V
Short circuit withstand time ²⁾ $V_{GE} = 15\text{V}$, $V_{CC} \leq 600\text{V}$, $T_j \leq 150^\circ\text{C}$	t_{SC}	10	μs
Power dissipation	P_{tot}	250	W
$T_C = 25^\circ\text{C}$			
Operating junction and storage temperature	T_j , T_{stg}	-55...+150	$^\circ\text{C}$
Time limited operating junction temperature for $t < 150\text{h}$	$T_{j(tl)}$	175	
Soldering temperature, 1.6mm (0.063 in.) from case for 10s	-	260	

¹ J-STD-020 and JESD-022

²⁾ Allowed number of short circuits: <1000; time between short circuits: >1s.

Thermal Resistance

Parameter	Symbol	Conditions	Max. Value		Unit
Characteristic					
IGBT thermal resistance, junction – case	R_{thJC}		0.5		K/W
Thermal resistance, junction – ambient	R_{thJA}	PG-TO-220-3-1 PG-TO-247-3-21	62 40		

Electrical Characteristic, at $T_j = 25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	Typ.	max.	

Static Characteristic

Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE}=0\text{V}$, $I_C=500\mu\text{A}$	600	-	-	V
Collector-emitter saturation voltage	$V_{CE(\text{sat})}$	$V_{GE} = 15\text{V}$, $I_C=30\text{A}$ $T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$		2.8 3.5	3.15 4.00	
Gate-emitter threshold voltage	$V_{GE(\text{th})}$	$I_C=700\mu\text{A}$, $V_{CE}=V_{GE}$	3	4	5	
Zero gate voltage collector current	I_{CES}	$V_{CE}=600\text{V}$, $V_{GE}=0\text{V}$ $T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$	- -	-	40 3000	μA
Gate-emitter leakage current	I_{GES}	$V_{CE}=0\text{V}$, $V_{GE}=20\text{V}$	-	-	100	nA
Transconductance	g_{fs}	$V_{CE}=20\text{V}$, $I_C=30\text{A}$	-	20	-	S

Dynamic Characteristic

Input capacitance	C_{iss}	$V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$, $f=1\text{MHz}$	-	1500		pF
Output capacitance	C_{oss}		-	150		
Reverse transfer capacitance	C_{rss}		-	92		
Gate charge	Q_{Gate}	$V_{CC}=480\text{V}$, $I_C=30\text{A}$ $V_{GE}=15\text{V}$	-	141		nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E	PG-TO-220-3-1 PG-TO-247-3-21	-	7 13		nH
Short circuit collector current ¹⁾	$I_{C(\text{SC})}$	$V_{GE}=15\text{V}$, $t_{SC} \leq 10\mu\text{s}$ $V_{CC} \leq 600\text{V}$, $T_j \leq 150^\circ\text{C}$	-	220		A

¹⁾ Allowed number of short circuits: <1000; time between short circuits: >1s.

Switching Characteristic, Inductive Load, at $T_j=25\text{ }^\circ\text{C}$

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	$T_j=25\text{ }^\circ\text{C}$, $V_{CC}=400\text{V}$, $I_C=30\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=11\Omega$	-	20		ns
Rise time	t_r		-	21		
Turn-off delay time	$t_{d(off)}$		-	250		
Fall time	t_f		-	25		
Turn-on energy	E_{on}		-	0.60		mJ
Turn-off energy	E_{off}		-	0.55		
Total switching energy	E_{ts}	Energy losses include "tail" and diode reverse recovery.	-	1.15		

Switching Characteristic, Inductive Load, at $T_j=150\text{ }^\circ\text{C}$

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	$T_j=150\text{ }^\circ\text{C}$, $V_{CC}=400\text{V}$, $I_C=30\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=1.8\Omega$	-	16		ns
Rise time	t_r		-	13		
Turn-off delay time	$t_{d(off)}$		-	122		
Fall time	t_f		-	29		
Turn-on energy	E_{on}		-	0.78		mJ
Turn-off energy	E_{off}		-	0.48		
Total switching energy	E_{ts}	Energy losses include "tail" and diode reverse recovery.	-	1.26		
Turn-on delay time	$t_{d(on)}$	$T_j=150\text{ }^\circ\text{C}$, $V_{CC}=400\text{V}$, $I_C=30\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=11\Omega$	-	20		ns
Rise time	t_r		-	19		
Turn-off delay time	$t_{d(off)}$		-	274		
Fall time	t_f		-	27		
Turn-on energy	E_{on}		-	0.91		mJ
Turn-off energy	E_{off}		-	0.70		
Total switching energy	E_{ts}	Energy losses include "tail" and diode reverse recovery.	-	1.61		

¹⁾ Leakage inductance L_σ and Stray capacity C_σ due to test circuit in Figure E.

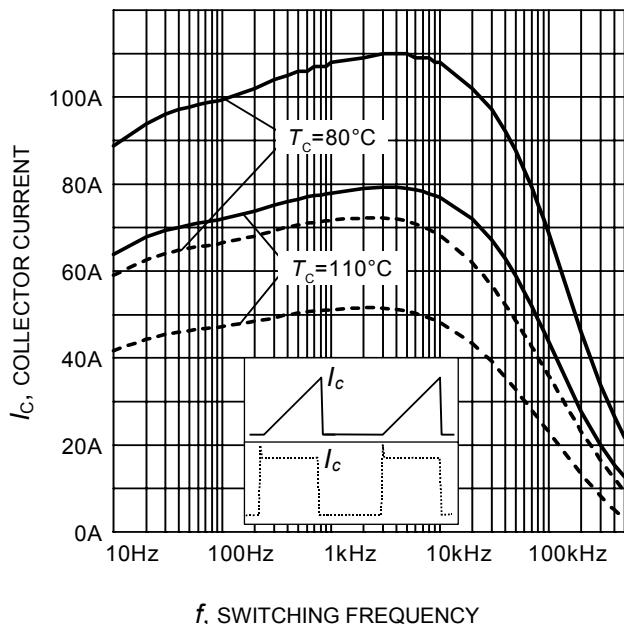


Figure 1. Collector current as a function of switching frequency

($T_j \leq 150^\circ\text{C}$, $D = 0.5$, $V_{\text{CE}} = 400\text{V}$,
 $V_{\text{GE}} = 0/+15\text{V}$, $R_{\text{G}} = 11\Omega$)

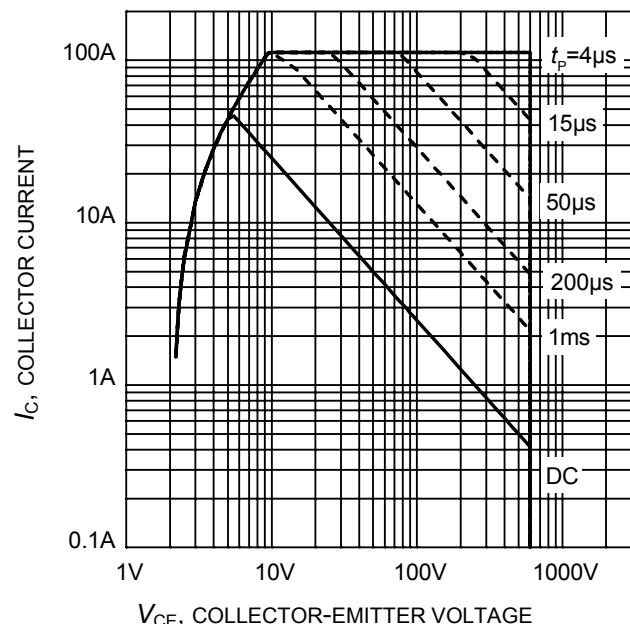


Figure 2. Safe operating area

($D = 0$, $T_c = 25^\circ\text{C}$, $T_j \leq 150^\circ\text{C}$;
 $V_{\text{GE}} = 15\text{V}$)

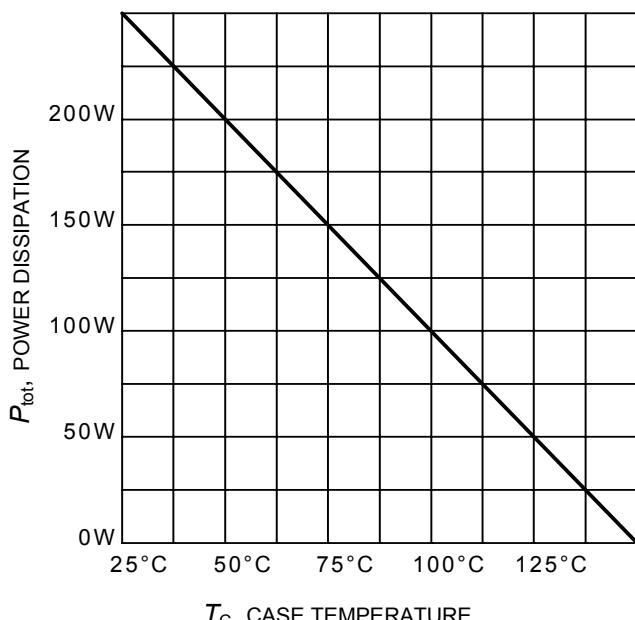


Figure 3. Power dissipation as a function of case temperature

($T_j \leq 150^\circ\text{C}$)

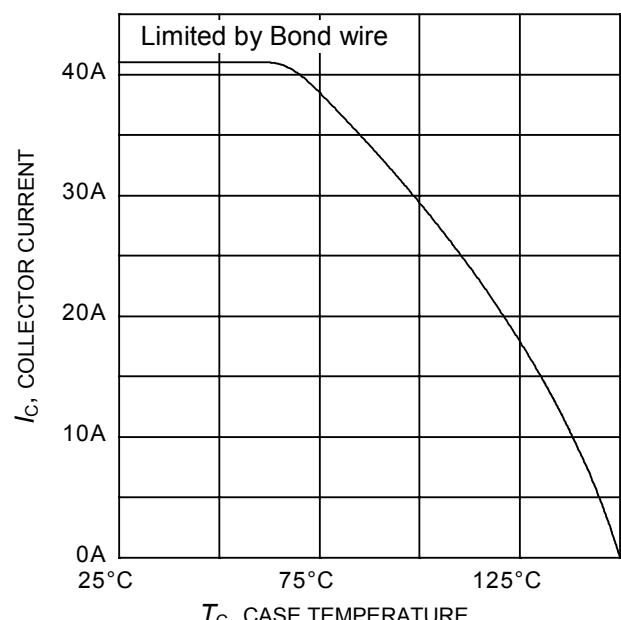


Figure 4. Collector current as a function of case temperature

($V_{\text{GE}} \leq 15\text{V}$, $T_j \leq 150^\circ\text{C}$)

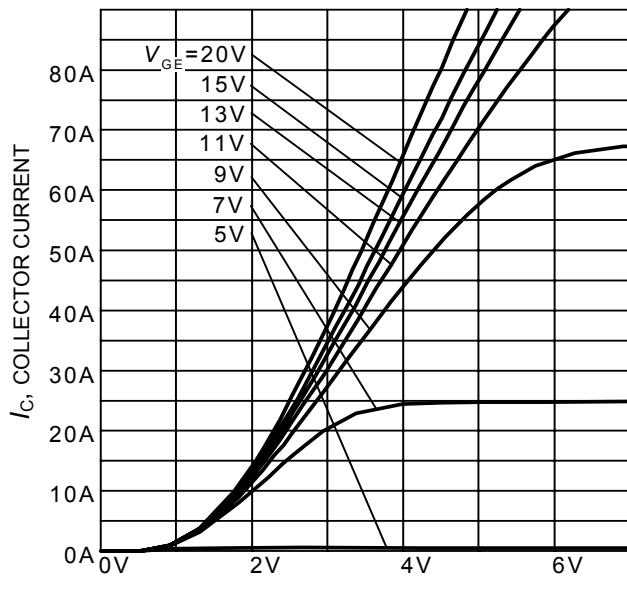

 V_{CE} , COLLECTOR-EMITTER VOLTAGE

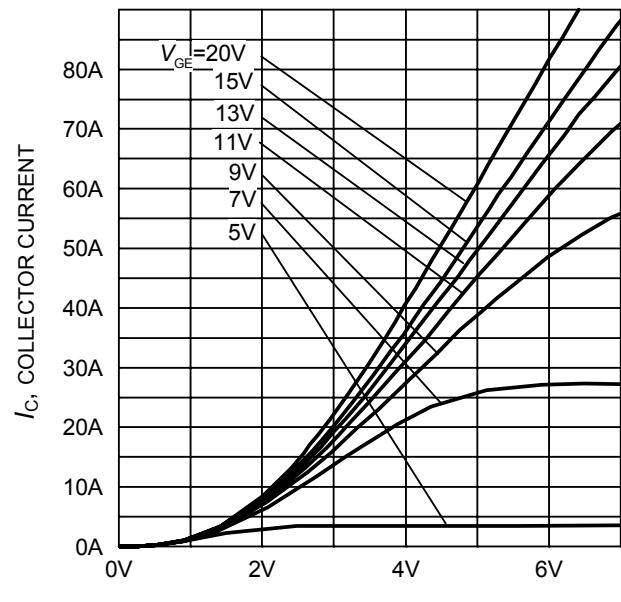
Figure 5. Typical output characteristic
 $(T_j = 25^\circ\text{C})$

 V_{CE} , COLLECTOR-EMITTER VOLTAGE

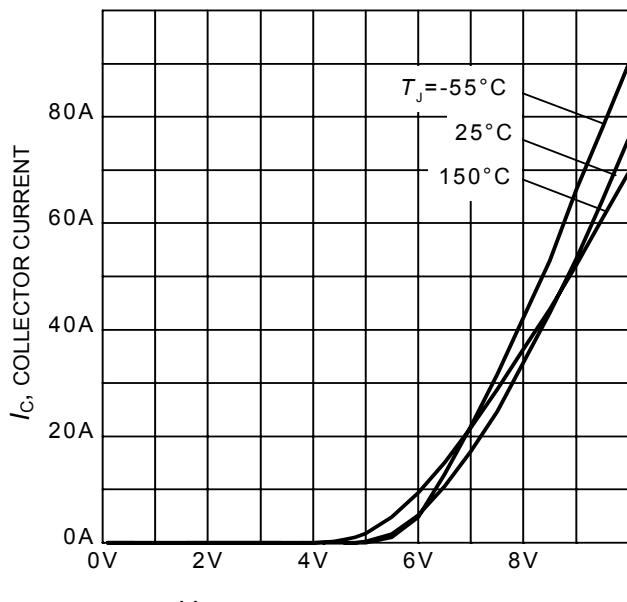
Figure 6. Typical output characteristic
 $(T_j = 150^\circ\text{C})$

 V_{GE} , GATE-EMITTER VOLTAGE

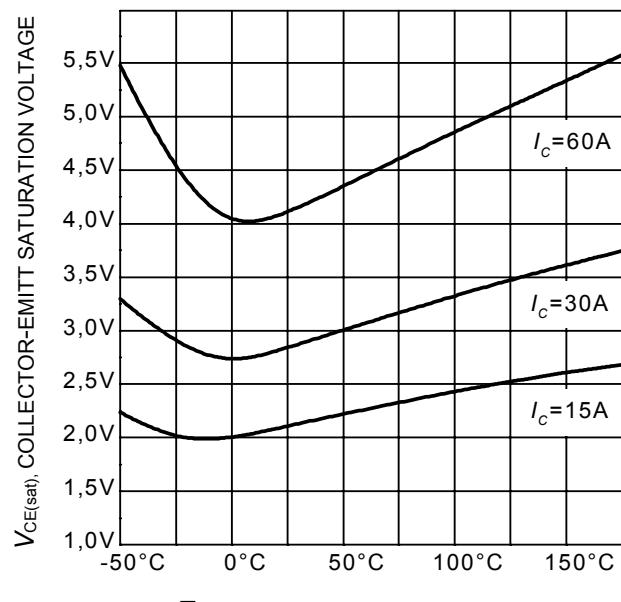
Figure 7. Typical transfer characteristic
 $(V_{CE} = 10\text{V})$

 T_j , JUNCTION TEMPERATURE

Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
 $(V_{GE} = 15\text{V})$

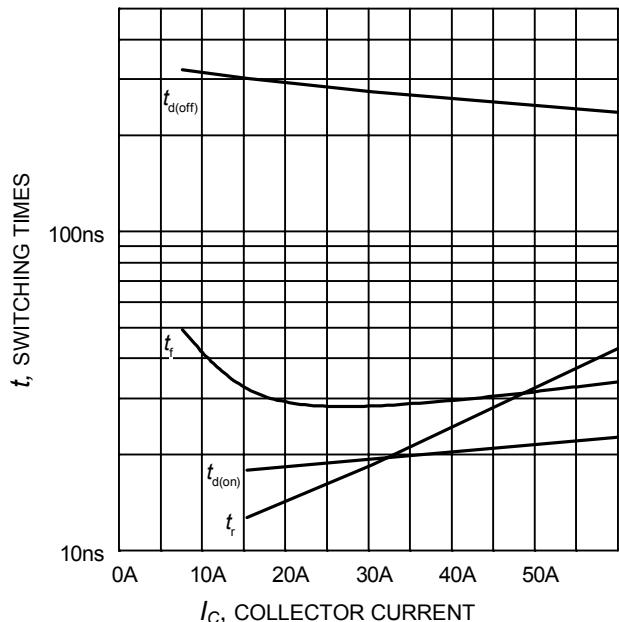


Figure 9. Typical switching times as a function of collector current
 (inductive load, $T_J=150^\circ\text{C}$,
 $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=11\Omega$,
 Dynamic test circuit in Figure E)

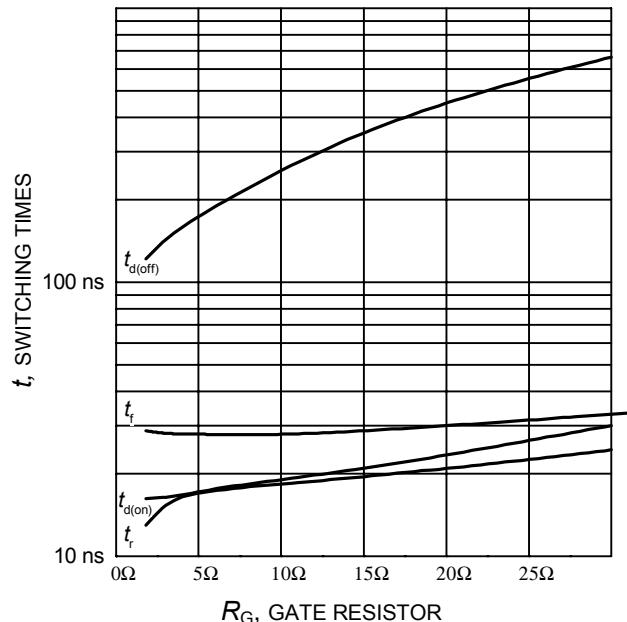


Figure 10. Typical switching times as a function of gate resistor
 (inductive load, $T_J=150^\circ\text{C}$,
 $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$,
 Dynamic test circuit in Figure E)

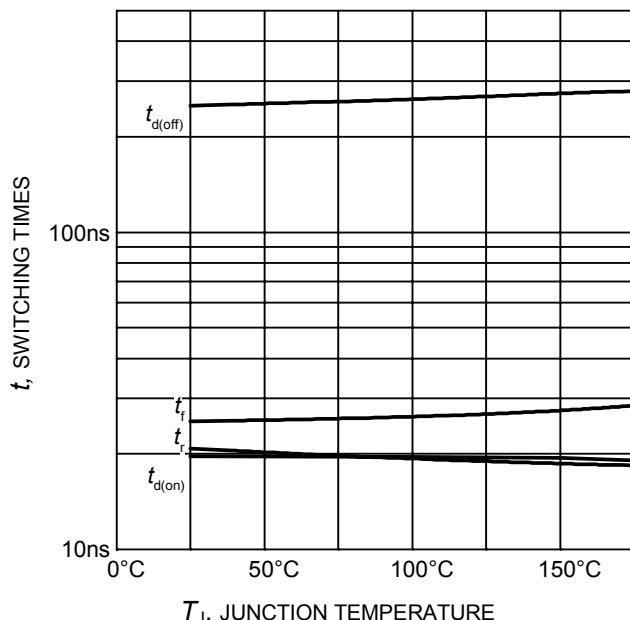


Figure 11. Typical switching times as a function of junction temperature
 (inductive load, $V_{CE}=400\text{V}$,
 $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$, $R_G=11\Omega$,
 Dynamic test circuit in Figure E)

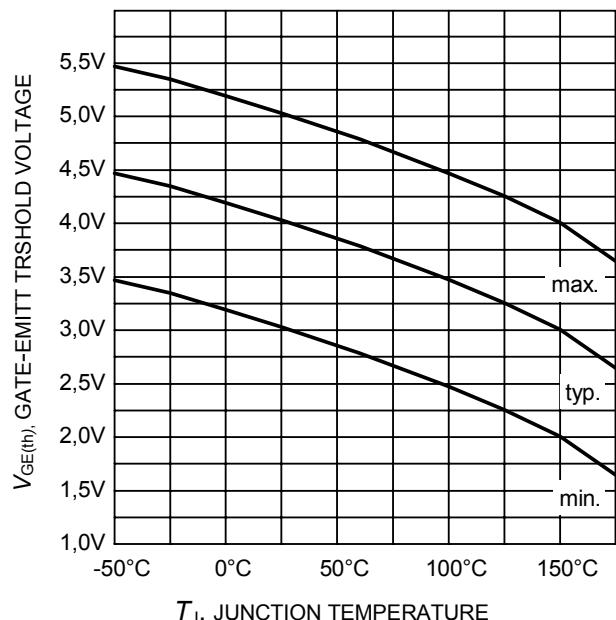


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
 $(I_C = 0.7\text{mA})$

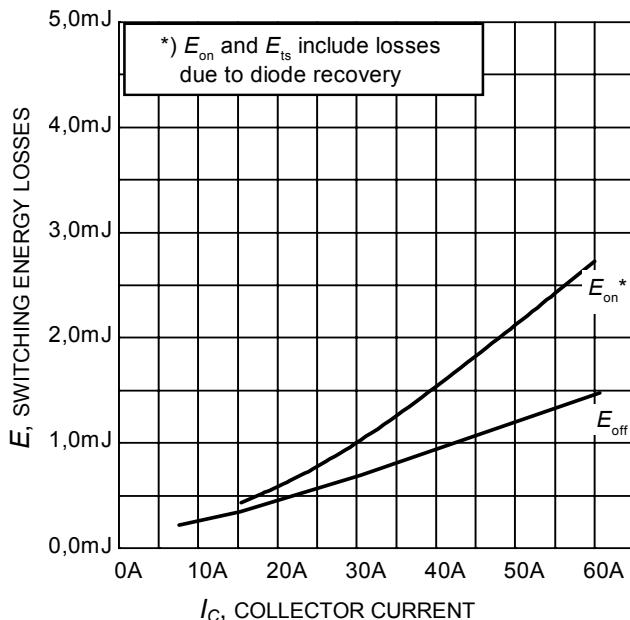


Figure 13. Typical switching energy losses as a function of collector current
 (inductive load, $T_J=150^\circ\text{C}$,
 $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=11\Omega$,
 Dynamic test circuit in Figure E)

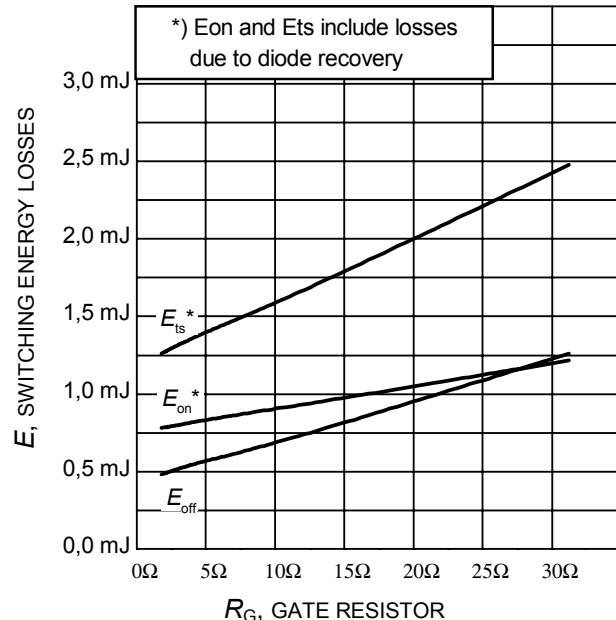


Figure 14. Typical switching energy losses as a function of gate resistor
 (inductive load, $T_J=150^\circ\text{C}$,
 $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$,
 Dynamic test circuit in Figure E)

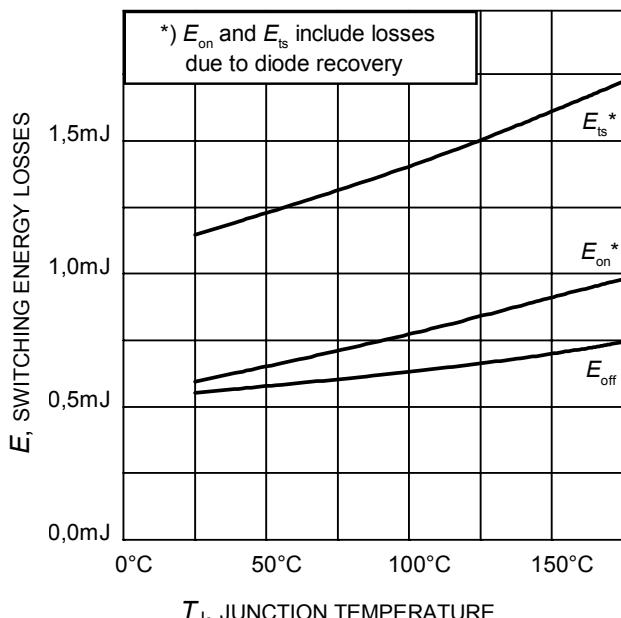


Figure 15. Typical switching energy losses as a function of junction temperature
 (inductive load, $V_{CE}=400\text{V}$,
 $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$, $R_G=11\Omega$,
 Dynamic test circuit in Figure E)

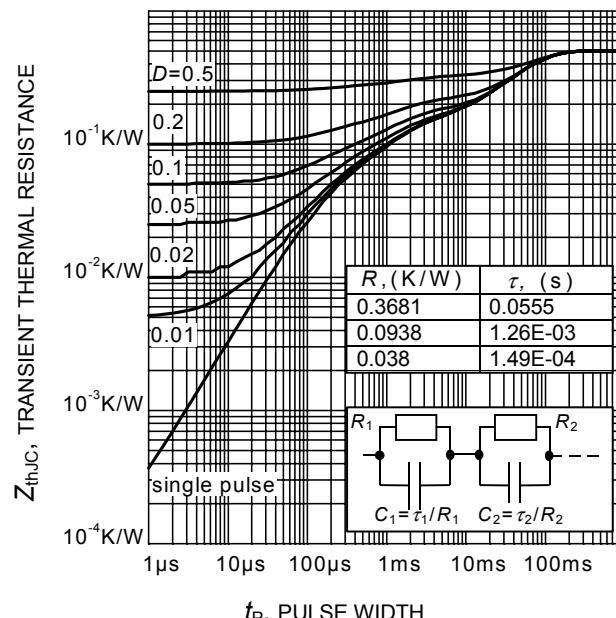
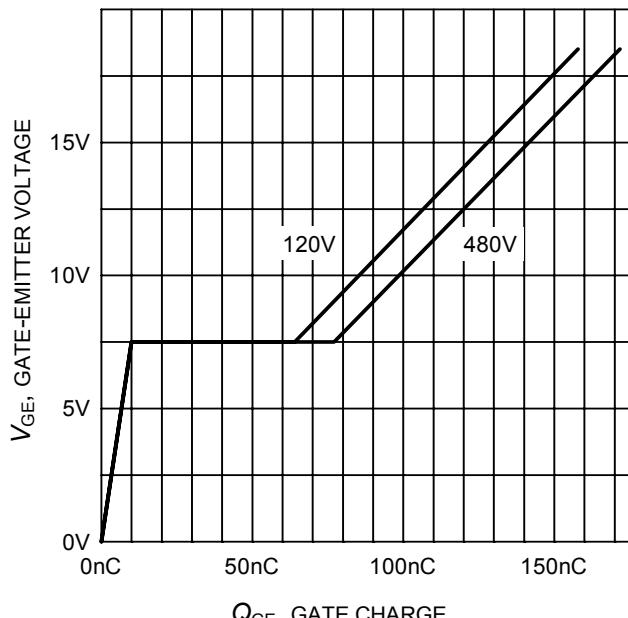
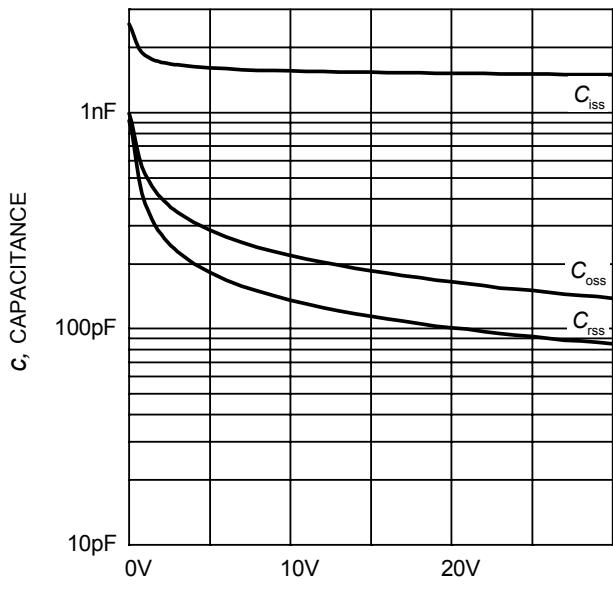


Figure 16. IGBT transient thermal resistance
 $(D = t_p / T)$



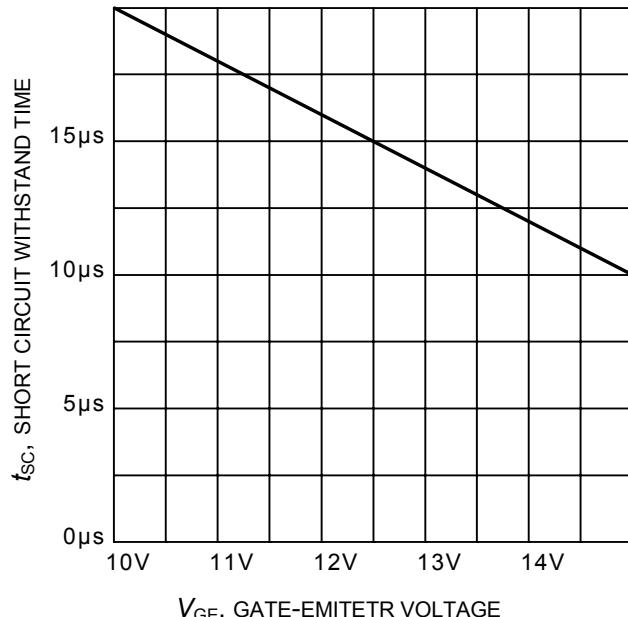
Q_{GE} , GATE CHARGE

Figure 17. Typical gate charge
 $(I_C=30\text{ A})$



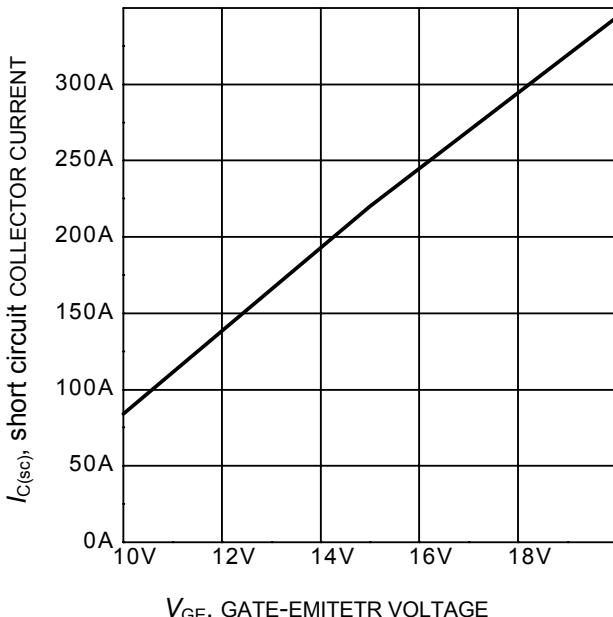
V_{CE} , COLLECTOR-EMITTER VOLTAGE

Figure 18. Typical capacitance as a function of collector-emitter voltage
 $(V_{GE}=0\text{V}, f=1\text{ MHz})$



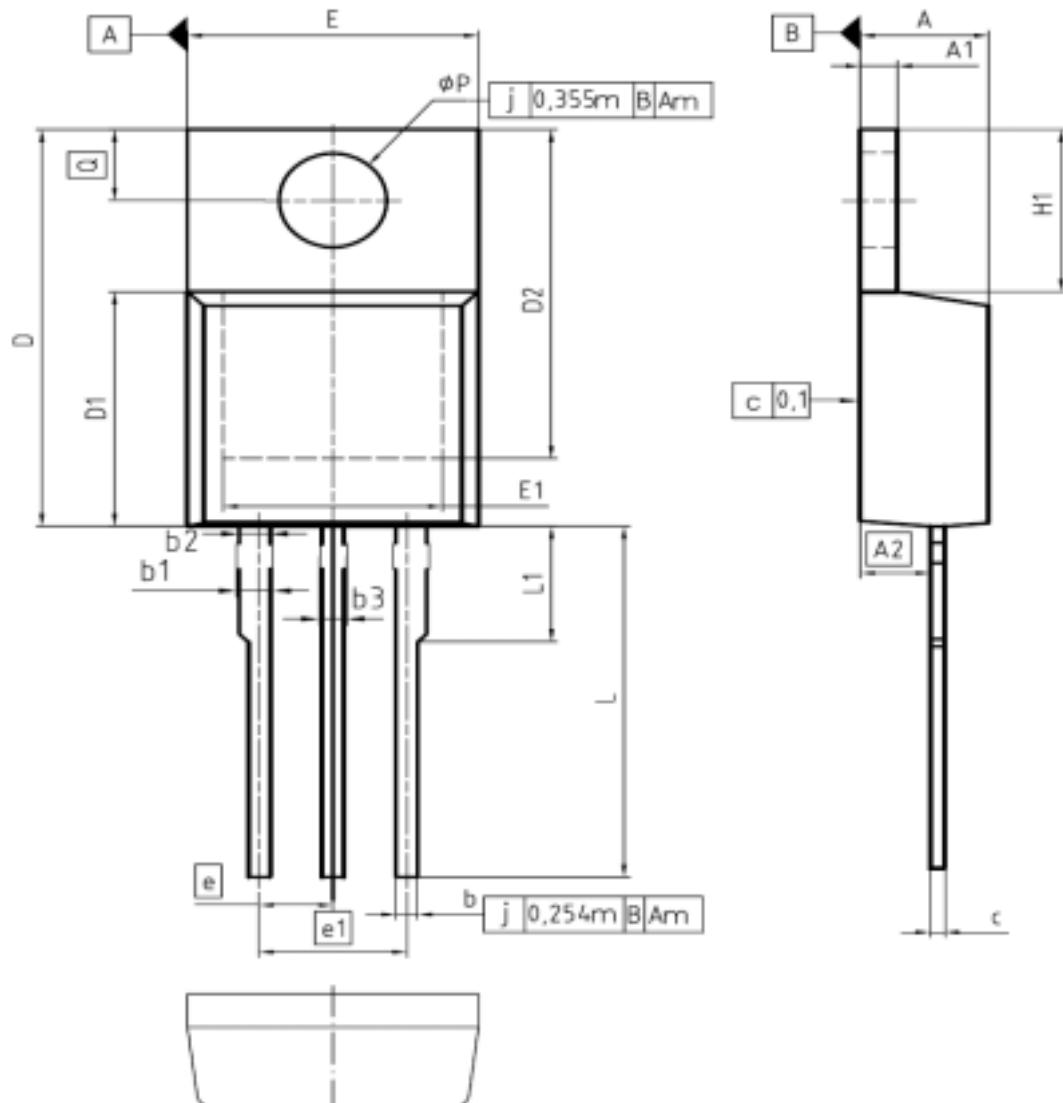
V_{GE} , GATE-EMITTER VOLTAGE

Figure 19. Short circuit withstand time as a function of gate-emitter voltage
 $(V_{CE}=600\text{V}, \text{start at } T_j=25^\circ\text{C})$



V_{GE} , GATE-EMITTER VOLTAGE

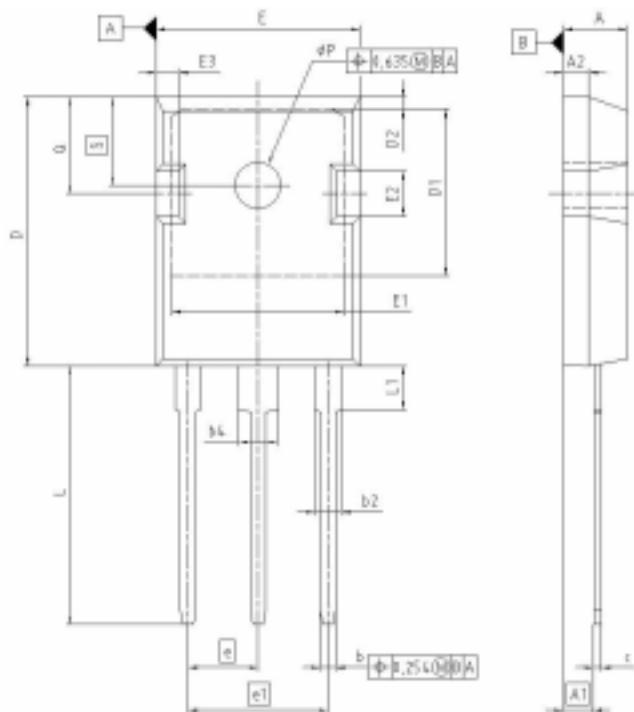
Figure 20. Typical short circuit collector current as a function of gate-emitter voltage
 $(V_{CE} \leq 600\text{V}, T_j \leq 150^\circ\text{C})$

PG-T0220-3-1


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.57	0.169	0.180
A1	1.17	1.40	0.046	0.055
A2	2.15	2.72	0.085	0.107
b	0.65	0.86	0.026	0.034
b1	0.95	1.40	0.037	0.055
b2	0.95	1.15	0.037	0.045
b3	0.65	1.15	0.026	0.045
c	0.33	0.60	0.013	0.024
D	14.81	15.96	0.583	0.628
D1	8.51	9.45	0.335	0.372
D2	12.19	13.10	0.480	0.516
E	9.70	10.36	0.382	0.408
E1	6.50	8.80	0.256	0.339
e	2.54		0.100	
e1	5.08		0.200	
N	3		3	
H1	5.90	6.90	0.232	0.272
L	13.00	14.00	0.512	0.551
L1	-	4.80	-	0.189
ϕP	3.60	3.89	0.142	0.153
Q	2.60	3.00	0.102	0.118

DOCUMENT NO.	Z8B00003318
SCALE	0 2.5 0 2.5 5mm
EUROPEAN PROJECTION	
ISSUE DATE	23-08-2007
REVISION	05

PG-T0247-3-21



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.900	5.157	0.193	0.200
A1	2.273	2.527	0.092	0.098
A2	1.653	2.167	0.065	0.061
b	1.071	1.277	0.047	0.052
b2	1.963	2.286	0.077	0.094
b4	2.670	3.454	0.113	0.136
c	0.549	0.752	0.022	0.030
D	20.823	21.077	0.820	0.850
D1	17.323	17.831	0.682	0.702
D2	1.063	1.317	0.042	0.052
E	15.778	16.027	0.614	0.631
E1	13.883	14.147	0.547	0.557
E2	3.883	3.987	0.145	0.155
E3	1.903	1.937	0.076	0.076
e	5.450		0.215	
e1	10.900		0.430	
M	3		3	
L	20.853	21.337	0.799	0.799
L1	4.666	4.472	0.184	0.176
eP	1.559	3.861	0.140	0.144
Q	5.405	5.747	0.213	0.225
S	6.043	6.297	0.239	0.248

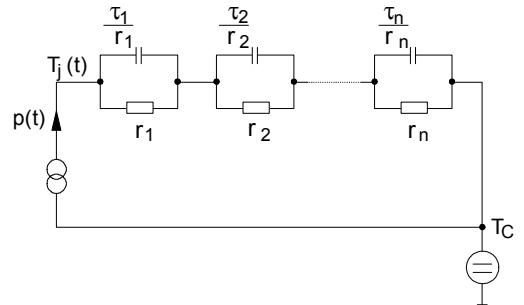
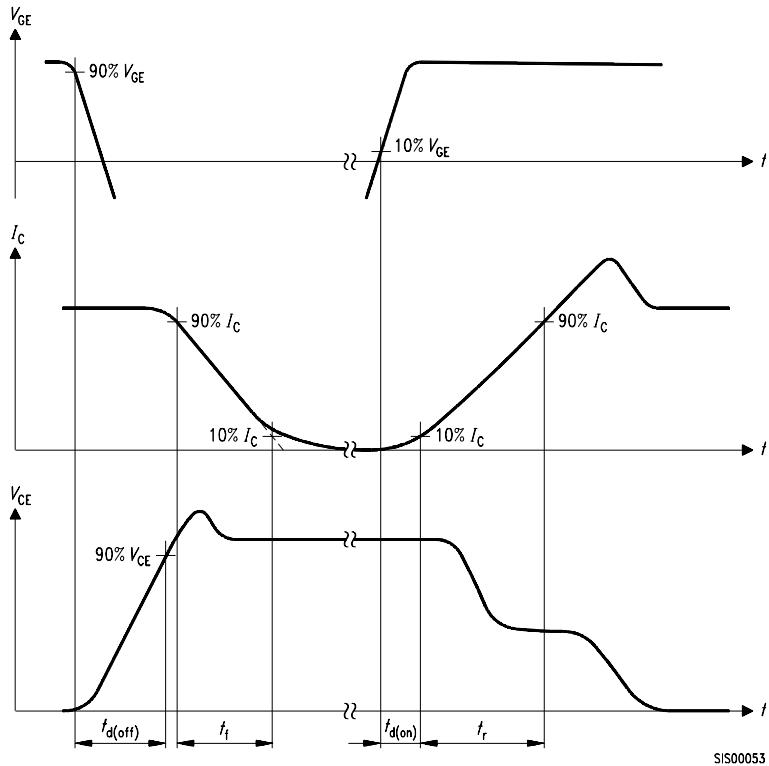


Figure D. Thermal equivalent circuit

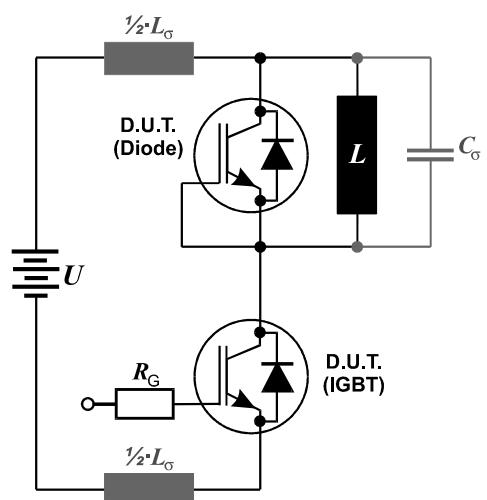
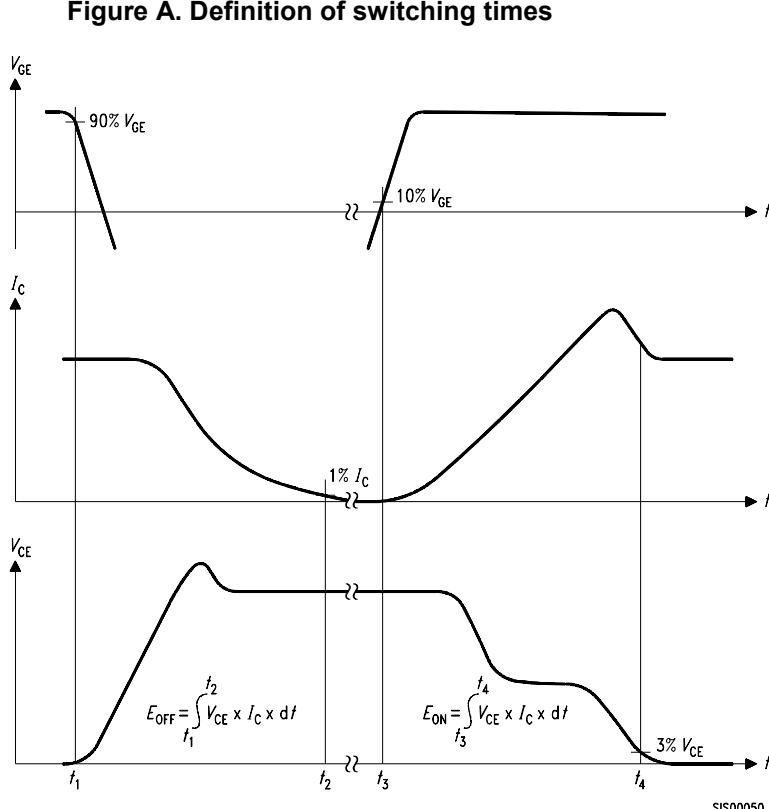


Figure E. Dynamic test circuit
 Leakage inductance $L_\sigma = 60\text{nH}$
 and Stray capacity $C_\sigma = 40\text{pF}$.

Edition 2006-01

Published by

**Infineon Technologies AG
81726 München, Germany**

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